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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

SPINOZA, Marc H. Atty. Ref.: 604-540

Serial No. Unassigned Group:

Filed: February 18, 2000 Examiner:

For: A METHOD OF SECURING A LINE TO A PATIENT, FASTENERS AND THEIR USE TO SECURE A LINE TO A PATIENT

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February 18, 2000

Assistant Commissioner for Patents
Washington, DC 20231

SUBMISSION OF PRIORITY DOCUMENTS

Sir:

It is respectfully requested that this application be given the benefit of the foreign filing date under the provisions of 35 U.S.C. §119 of the following, a certified copy of which is submitted herewith:

Application No.	Country of Origin	Filed
9717821.4	Great Britain	21 August 1997

Respectfully submitted,

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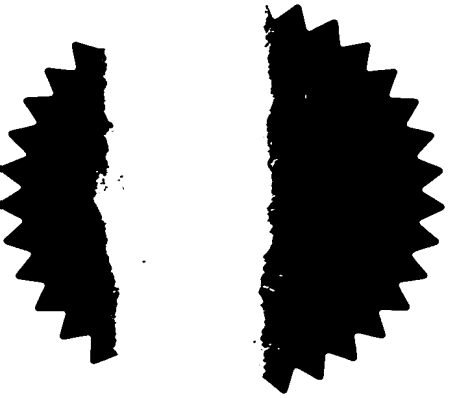

Signed P. Mahoney

Dated 8 February 2000

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Request for grant of a patent

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1. Your reference — SPC/3345

2. Patent application number *(The Patent Office will fill in this part)* — **9717821.4** — 21 AUG 1997

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

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Patents ADP number *(if you know it)*

If the applicant is a corporate body, give the country/state of its incorporation

7272073001

4. Title of the invention

FASTENERS

Form 51/77 2/2/00

5. Name of your agent *(if you have one)*

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

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Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

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11. I/We request the grant of a patent on the basis of this application.

Signature David Keltie Associates Date

DAVID KELTIE ASSOCIATES 21 August 1997

12. Name and daytime telephone number of person to contact in the United Kingdom

S. Cummings 0171 583 6000

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FASTENERS

The present invention relates broadly to the field of fasteners and is particularly concerned with medical or surgical fasteners that secure tubes or other lines to a patient.

In one example, the invention can be used to secure a catheter to a patient's arm or umbilicus, and in another example the invention can be used to hold an endotracheal tube that ventilates a patient. The catheter application will be described first, with particular reference to the treatment of premature babies or of term babies requiring resuscitation measures. This field is the Applicant's speciality as a doctor, and is the origin of the present invention.

Catheters are long, thin, flexible tubes of plastics material that can be inserted into a blood vessel or other body cavity for introducing or removing fluid. They are used by medical personnel as a matter of routine. Catheters can vary widely in size, depending upon the application: from about 0.5 mm internal diameter for use with premature babies, up to more than 3 mm internal diameter for use with adults. They often have measurement markings provided along their length, the markings serving as a guide to the depth of insertion into the patient's body.

Premature infants, or term infants requiring resuscitation measures, invariably require the ongoing administration of drugs and fluids. Moreover, frequent blood samples must be taken to monitor the infant's progress, bearing in mind that infants can deteriorate very rapidly if things go wrong without being detected promptly. Clearly, therefore, it is vital that good venous/arterial access is achieved and maintained.

Venous/arterial access through peripheral access sites such as the arms, legs or scalp is to be avoided if at all possible. As infant patients can be so small, it is desirable to avoid puncturing their blood vessels even if suitable blood vessels can be found: peripheral access is usually very limited. Moreover, serious injury can ensue when administering certain drugs or fluids peripherally, ranging from superficial tissue damage to permanent disfigurement. Plastic surgery may be required for these peripheral injuries and, in later

life, orthopaedic intervention may be required to treat damaged joints.

Conversely, the venous and arterial vessels found within the normal anatomy of an umbilical cord (i.e. at the umbilical stump or umbilicus) provide ready access to a infant's bloodstream and so are favoured over peripheral access sites. Accordingly, unless complications arise which inhibit use of the umbilicus, the usual practice is to site small diameter umbilical catheters (also known as lines) in the umbilicus as soon as possible after birth. Once in situ, these lines readily allow fluids including transfusions and drugs to be administered and blood samples to be taken.

When locating a line inside an infant's body, a nurse or doctor has to be careful to place the line in a position that least compromises the dynamics of the cardiovascular system. This is a trial-and-error process, involving an attempt at correct positioning followed by an X-ray to confirm the actual position of the end of the line. At that stage, if the line is found to extend beyond its target position, it can be pulled back. On the other hand, if the line falls short of the target, the risk of introducing infection means that the line is never inserted any deeper. Instead, the original line is withdrawn and discarded and a sterile replacement line is sited: the positioning procedure begins all over again.

Clearly, once a line is in an acceptable position after this intricate positioning procedure, it is essential that the line is securely anchored to avoid any accidental displacement with respect to the infant's umbilicus. The line may need to be in place for a period of weeks: the longer a line remains undisturbed in situ in accordance with planned treatment, the lower the risk of harm to the patient. With premature infants in particular, lines are essential: if access via them is lost, the risk of a poor outcome or even death is notably higher. Dislodgement of a line is most undesirable because reinsertion not only increases the risk of introducing infection, but also is difficult to achieve because the umbilicus tends to close up tightly a few days after birth.

The current and long-standing line-anchoring practice is to suture the line directly to the umbilicus and then to construct a securing bridge from medical adhesive tape applied to the abdomen. This adhesive tape bridge takes the stress of axial loads on the line at

points spaced from the umbilicus, thereby minimising disturbance to the umbilicus.

In a common construction illustrated in Figure 1, an adhesive tape bridge 10 is made from a total of six strips of medical adhesive tape. Two pairs of strips are adhesively secured to the baby's abdomen 11 one each side of, and spaced from, the umbilicus 12. Each pair is shaped into an inverted V and the pairs are mutually parallel with their apices aligned with the umbilicus, creating upstanding supports. The remaining two strips of tape are applied face-to-face about the line 13 and their ends are attached to the apices of the supports, thus bridging the gap between the supports and gripping the line 13.

The adhesive tape bridge is cheap and simple but suffers a number of problems. Perhaps most seriously, and no matter how carefully an adhesive tape bridge is constructed, it will deteriorate over time. It may ultimately fall apart or otherwise fail to grip the line, thus presenting a danger of the line being displaced. Clearly, this risk increases the longer an adhesive tape bridge is relied upon: it must be inspected frequently and if necessary renewed. Of course, inspection and renewal are operations that can themselves disturb the line.

If an adhesive tape bridge fails to grip a line, the line can be pulled out or otherwise displaced from its ideal location by movements of the infant, as well as by disturbances when medical personnel carry out clinical procedures on the infant such as re-intubation, taking samples, changing nappies/diapers, cleaning and so on. Paradoxically, any disturbance of the line can be hidden by the bulky adhesive tape bridge and so escape detection. Wholly unnecessary death or disability is the all too frequent result.

The infant's movements and the disturbance of clinical procedures can, of course, also contribute to the deterioration of the adhesive tape bridge. However, the main factor in deterioration stems from the fact that a premature infant's skin is immature, undeveloped and hence very permeable. Coupled with an infant's large surface area to weight ratio, this leaves the infant liable to dehydration. This is the reason why premature infants are kept in a humidified atmosphere within incubators or bubble coverings. Over time, the

moisture promoted by these humid surroundings can weaken the bonds that hold together an adhesive tape bridge and that hold the bridge in place on an infant's skin.

Other disadvantages of the adhesive tape bridge are that adhesive contact with a premature infant's abdomen could damage the infant's extremely fragile and sensitive skin, and that its construction takes valuable time.

Some of the shortcomings of adhesive tape bridges are addressed in US Patent No. 5,370,627 to Conway. Conway discloses a catheter securing bridge that consists of an annular base having a central aperture and two semi-circular flaps pivotally connected to the base. The underside of the base is coated with an adhesive layer, as are the opposing faces of the flaps.

In use, the base is adhesively secured to the infant so that it encircles the umbilicus which is thus presented in the middle of the aperture. Next, the catheter is introduced into the umbilicus, and once properly located is sutured in place on the umbilicus. The flaps are lifted up towards one another so that they extend upwardly from the base and are then adhesively secured together, trapping a portion of the projecting catheter.

Whilst Conway's catheter securing bridge represents an improvement over the conventional adhesive tape bridge in terms of convenience of application, it is apparent that Conway has taken the adhesive tape bridge as a starting point. Conway's device therefore shares many of the problems suffered by the adhesive tape bridge: in particular, it will eventually work loose and will therefore allow the catheter to become displaced.

Neonatal care requires exceptional precision but, of course, it is not the only medical or surgical field that requires reliable and convenient location of a catheter. Intravenous drips and urethral catheters are merely examples of many other applications that would benefit from better catheter fasteners.

Analogous problems are experienced in fastening an endotracheal tube used to ventilate

a patient: see Figure 2. When intubating the patient 14, the endotracheal tube 15 is passed through a silicone rubber collar 16 held on the patient's mouth by a net or stocking hat and ribbon ties (not shown) that pass through holes 17 in the collar 16 and is fixed to the collar 16 by a cable tie 18 or suture (not shown). The patient 14 is then x-rayed to ensure that the end of the endotracheal tube 15 is correctly positioned just above the bifurcation of the trachea, i.e. the point where the trachea branches into the bronchi. If the endotracheal tube 15 is not correctly positioned - and adjustment is usually required - the cable tie 18 or suture must be removed, the tube 15 pulled out or pushed in (the risk of infection is acceptable in this instance because the trachea is always exposed to the environment), the cable tie 18 or suture must be re-affixed and then another x-ray must be performed to confirm correct positioning. Repeated removal and replacement of the cable tie 18 or suture takes time, costs money and generally militates against correct positioning of the endotracheal tube 15.

It is the essential that the endotracheal tube is accurately positioned to avoid injury at the bifurcation of the trachea or only one side of the chest (usually the right side) being inadvertently ventilated.

It is against this background that the invention has been devised.

From one aspect, the invention resides in a method of securing a line to a patient or of adjusting the position of a line thus secured, comprising elongating and narrowing a sleeve applied to the line to grip the line and resist movement of the line along its longitudinal axis with respect to the sleeve.

Analogously, the invention encompasses a fastener for securing a line to a patient comprising a sleeve of variable length capable when lengthened of gripping the line.

The invention has many benefits. It provides a simple, cheap and effective solution to the problem of securing lines to a patient, especially to a premature infant in moisture-ridden environments. The sleeve of the invention is so cheap as to be disposable without undue cost. The invention provides versatility, flexibility and adjustability, although it

can as easily be permanently fixed. Most importantly, the invention avoids injury to a patient and indeed can be expected to save many lives.

Preferably, after first gripping the line, the sleeve elongates in response to movement of the line and resists continuance of that movement. This provides a locking effect.

To allow adjustment, the method of the invention may further comprise shortening and widening the sleeve to release the line and permit movement of the line. Advantageously, the sleeve can be shortened by pushing its ends towards one another. Thus shortened, the sleeve is capable of sliding along the line.

The line may be passed out of the sleeve through a wall of the sleeve, and further may be passed back into the sleeve through the wall of the sleeve. In this way, the line can be led to wherever it may be needed with respect to the sleeve, and can be used to create loops in the sleeve for attachment purposes.

The invention allows a method of securing the line, checking the position of the line with respect to the patient by x-ray or other means, adjusting the line into a desired position, and locking it in the desired position. If desired, locking can be achieved by adhesively connecting the line and the sleeve.

The fastener of the invention suitably includes attachment means for attaching the sleeve to a patient. The attachment means preferably comprises one or more loops, which may be formed by doubling over the sleeve.

To reduce the reliance upon adhesive still further, the attachment means advantageously comprises a harness, sling or other means adapted to embrace a part of the patient.

The fastener of the invention can comprise a support such as the body of a collar for an endotracheal tube, together with movable means for varying the length of the sleeve with respect to the support. To provide a measure of self-locking, the movable means preferably includes bias means acting to elongate the sleeve. Conveniently, the movable

means includes at least one lever acting upon the sleeve which may be a finger tab movable against the bias means to shorten the sleeve.

For optimum flexibility, the sleeve preferably has a perforated or foraminous wall defining a plurality of openings. An opening may be capable of permitting the line to pass through the wall of the sleeve.

To this end, the sleeve wall is preferably a mesh, grid, net or web and may be of filamentary construction such as a spirally woven tube.

In order that the invention can be more readily understood, reference will now be made, by way of example only, to the accompanying drawings in which:

Figure 1 is a schematic perspective view of a prior art technique for securing a line to the umbilicus of a premature infant, using an adhesive tape bridge;

Figure 2 is a schematic perspective view of a prior art technique for securing an endotracheal tube to a patient, using a cable tie or suture to attach the tube to a collar;

Figure 3 is a schematic side view of a fastener constructed in accordance with the invention;

Figures 4(a) and 4(b) are schematic side views illustrating the response of the fastener of Figure 3 to longitudinal compression and tension respectively;

Figures 5(a) to 5(l) diagrammatically illustrate a series of steps in applying the fastener of Figure 3 to an umbilical line;

Figure 6 is a schematic plan view of a harness for use with the invention;

Figure 7 is a schematic plan view of an adhesive tab for use with the invention;

Figure 8 is a schematic perspective view of the adhesive tab of Figure 8 and the fastener of Figure 3 in use together on a patient;

Figure 9 is a schematic perspective view of a collar employing the invention to secure an endotracheal tube to a patient instead of the cable tie or suture used previously as in Figure 2;

Figures 10(a), 10(b) and 10(c) are schematic perspective views of a sleeve and biasing means forming part of the collar shown in Figure 9; and

Figures 11(a) and 11(b) are schematic side views of alternative loop-forming techniques.

Reference has already been made to Figures 1 and 2 in the foregoing discussion of the prior art. Referring then to Figure 3, a fastener 19 constructed in accordance with the present invention includes a generally tubular sleeve 20 defined by helically-wound and interwoven or intertwined filaments of nylon. The wall of the sleeve 20 may therefore be described as a braid or plait of foraminous or perforated mesh, grid, net or web, defining numerous openings which can be expanded or contracted as will become evident.

One end of the sleeve 21 is open and the other end 22 is closed. The closed end 22 includes attachment means in the form of loops 23 formed by doubling back and laterally compressing an end of the sleeve 20 and inserting the compressed end back into the sleeve 20 through an opening in its wall. The doubled-back sleeve 20 is glued in place so as to hold the loop formation.

For use in anchoring umbilical lines, the sleeve 20 preferably measures approximately 1 mm in internal diameter and 200 mm in overall length when at rest, with the loops 23 being around 20 mm in diameter.

A notable characteristic of the sleeve 20 is that its length can readily be varied by axial compression or tension and that this variation in length has a direct and marked effect

upon the diameter of the sleeve 20. Elongation causes the sleeve 20 to narrow whereas shortening the sleeve 20 makes it wider. The helically-wound construction promotes this effect as shown in Figures 4(a) and 4(b). In these diagrams, the filaments 24 are shown schematically as intersecting hoops, shown edge-on, that lie at mutually opposite and equal angles with respect to the longitudinal axis of the sleeve 20.

In Figure 4(a), the sleeve 20 is shown in a compressed condition with the filaments 24 bunched up. The filaments 24 lie at a relatively large angle to the longitudinal axis of the sleeve 20, and the transverse diameter of the sleeve 20 is therefore at a maximum. Figure 4(b), in contrast, shows the sleeve 20 in an elongated condition. In this instance, the filaments 24 lie at a relatively small, more acute angle with respect to the longitudinal axis of the sleeve 20 and hence the transverse diameter of the sleeve 20 is at a minimum. In this elongated and narrow state, the filaments tightly grip a line 25.

With reference now to the series of illustrations in Figures 5(a) to 5(l), the sequence of steps involved in using a sleeve 20 to locate an umbilical line 25 will be described.

First of all and referring in this regard to Figure 5(a), an umbilical line 25 is threaded into the open end 21 of the sleeve 20. In Figure 5(b), the line 25 is shown being fed up the sleeve 20 towards the closed end 22. The progress of the line 25 within the sleeve 20 is eased by gripping the sleeve 20 with the fingers and longitudinally compressing it to shorten it and hence widen its internal diameter. This allows the line 25 to slide freely within the sleeve 20.

Once the line 25 nears the closed end 22 of the sleeve 20, a monofilament 26 is tied to the pair of loops 23 as shown in Figure 5(c). Then a silicone rubber collar 27 of about 20 mm in length and 2 mm in diameter is threaded onto the monofilament 26 (Figure 5(d)) and slid along it and over the sleeve 20 (Figure 5(e)) until it covers the open end 21 of the sleeve 20, at which point the monofilament 26 is untied and discarded (Figure 5(f)). The collar 27 holds together the free ends of the filaments 24 making up the sleeve 20 and so prevents the open end 21 of the sleeve 20 from fraying and unravelling.

The line 25 is then passed through one of the openings in the sleeve wall (Figure 5(g)) near its closed end 22, following which the sleeve 20 is again longitudinally compressed and slid up along the line 25 pulling through as much line 25 as is required (Figure 5(h)).

At this stage, the line 25 is ready to be introduced into the umbilicus 12 of a premature infant 11 as shown in Figure 5(i) and 5(j). Once the line 25 has been inserted into the umbilicus 12 and its position correctly located, the line 25 is sutured to the umbilicus 12. A harness 28 is passed around the baby's abdomen and attached to the loops 23 of the sleeve 20 as shown in Figure 5(j). The harness 28 will be described in more detail below with reference to Figure 6.

Final adjustments to the line 25 are made and then the sleeve 20 is ready to be locked to the line 25. This is achieved by tensioning the sleeve 20 by pulling it over the line 25 as shown in Figure 5(k) to elongate and narrow it. In doing so, the helically woven filaments frictionally engage the line 25, collectively imparting an evenly distributed and firm but gentle compressive gripping force over a large area of the line 25. This ensures that the line 25 is secured without restricting its lumen, as could happen if a point loading were applied to the line 25.

The gripping force exerted by the sleeve 20 naturally increases the frictional forces that resist axial movement of the line 25 with respect to the sleeve 20. Moreover, once the compressive and hence frictional forces rise above a certain threshold, it will be clear that further attempts to move the line 25 axially with respect to the sleeve 20 will meet with increased compression and frictional forces that tend to resist the movement ever more strongly without allowing further slippage. This gives rise to a locking effect.

Release of the line 25 is possible simply by longitudinally compressing the sleeve 20 to expand it away from the line 25, thereby allowing adjustments to be made by sliding the line 25 within the sleeve 20. The line 25 can be locked again when desired.

It has been found during testing that the line 25 will break - under loads far in excess

of anything encountered in normal use - rather than slip within the sleeve 20 once locked in this way. Nevertheless, in a final optional step, permanent fixing of the sleeve 20 in relation to the line 25 can be achieved by applying medical super glue 29 such as Braun Hystoacryl (trade mark) between the sleeve 20 and the line 25 as shown in Figure 5(l).

Referring now to Figure 6 of the drawings, the harness 28 shown in Figure 5(j) is an elongate strip of foam 'velcro' (trade mark) material including a relatively wide central section 30 extending smoothly into relatively narrow opposed ends 31. Each end 31 has a patch 32 of velcro material capable of gripping the material from which the remainder of the harness 28 is made.

In use when securing a sleeve 20 to a patient, the ends 31 of the harness 28 are passed through respective loops 23 of the sleeve 20 and are doubled back and secured to the remainder of the harness 28, thereby creating a loop interlocking with each loop 23 of the sleeve 20. The harness 28 passes around the patient's body or part thereof, with the wide central section 30 spreading contact loads and hence promoting comfort while resisting slippage.

If necessary, frictional contact between the harness 28 and the patient may be supplemented by exposing the adhesive surface of an adhesive section 33 located centrally within the central section 30 of the harness 28 and using this to adhesively secure the harness 28 to the patient. Advantageously, the adhesive section 33 has a multi-part peel-off cover allowing a variable proportion of the adhesive surface to be exposed, thereby allowing the minimum practical adhesive contact with the patient's skin as the loads of use may allow.

Figure 7 illustrates an adhesive tab 34 which functionally and structurally is akin to one half of the harness 28 shown in Figure 6. The tab 34 is generally spoon-shaped in plan, having a relatively wide end 35 and a relatively narrow end 36. The wide end 35 has an enlarged adhesive section 37 and the narrow end 36 has a velcro patch 38 capable of forming a loop interlocking with the loop 23 of a sleeve 20. The adhesive section 37 is used to attach the tab 34 to a patient's skin. Two or more such tabs 34 are preferably

used, as shown in Figure 8 which shows the invention applied to a line 25 cited for venous access in a patient's wrist using a Venflon (trade mark) 39.

Referring now to Figure 9, a collar 40 constructed in accordance with the invention is broadly the same as the collar 16 shown in use in Figure 2. The exceptions are:

an internal sleeve 41 of the same mesh construction as the sleeve 20 shown in Figures 3, 4(a) and 4(b);

bias means in the form of a coil compression spring 42 coaxial with and acting upon the sleeve 41 to elongate the sleeve 41; and

levers in the form of finger tabs 43, one fixed to the collar 40 at one end of the sleeve 41 and the other attached to and movable with the other end of the sleeve 41 whereby the sleeve can be longitudinally compressed against the force of the spring 42 by squeezing the movable finger tab 43 towards the fixed finger tab 43.

As best shown in Figures 10(a), 10(b) and 10(c), the spring 42 bears against rings 44 attached to respective ends of the sleeve 41. One ring 44 is fixed to the collar 40 and the other ring 44 is movable with respect to the collar 40, the movable finger tab 43 conveniently being attached to or integral with the movable ring 44. Although not shown in Figures 10(a), 10(b) or 10(c), the movable finger tab 43 travels in a slot 45 provided in the collar 40 as shown in Figure 9.

Figure 10(a) shows the sleeve 41 at the maximum extension permitted by the collar 40. When it is desired to admit a line 25 to the collar 40 as shown in Figure 10(b), the sleeve 41 is longitudinally compressed and hence widened by squeezing together the finger tabs 43. When the line 25 has been slid within the sleeve 41 to be positioned where desired, the finger tabs 43 are released which allows the sleeve 41 to lengthen and narrow under the influence of the spring 42 as shown in Figure 10(c), thereby tightly gripping the line 25.

Referring finally to Figures 11(a) and 11(b), the openings in the wall of the sleeve 20/41 can be exploited by passing the line 25 out of the sleeve 20/41 and back in again to create one or more loops 46 for fastening purposes. The open loops 46 of Figure 11(a) can be closed up as shown in Figure 11(b) merely by sliding together the ends of the sleeve 20/41 along the line 25.

Whilst most lines attached to a patient will be tubes, it is possible that non-tubular lines such as wires for sensing purposes could be attached to a patient by means of the invention.

Many other variations are possible without departing from the inventive concept. For example, it is envisaged that the invention could be used to secure lines in any patient when traditional methods of taping or suturing are compromised by conditions such as burns, plaster casts, dermatological problems and so on.

The invention could be of particular use in veterinary work for securing lines in animals, where fur, scales or feathers preclude traditional methods.

In its broadest sense, the invention could be used with benefit outside the medical and surgical fields. One such application is in securing industrial lines which deliver or remove liquids or gases via flexible tubing. Another such application is in securing fibre-optic lines as used in telecommunication systems. For all of these reasons, the invention is not confined by particular material choices or by other selections: many plastics other than nylon can be used and non-plastics such as metallic filaments are possible, as are bias means other than coil compression springs.

In general, the present invention may be embodied in other specific forms without departing from its essential attributes. Accordingly, reference should be made to the appended claims and other general statements herein rather than to the foregoing specific description as indicating the scope of the invention.

CLAIMS

1. A method of securing a line to a patient or of adjusting the position of a line thus secured, comprising elongating and narrowing a sleeve applied to the line to grip the line and resist movement of the line along its longitudinal axis with respect to the sleeve.

2. A method according to claim 1 wherein, after gripping the line, the sleeve elongates in response to said movement of the line and resists continuance of said movement of the line.

3. A method according to claim 1 or claim 2, wherein the sleeve is elongated by pulling its ends away from one another.

4. A method according to any preceding claim, comprising shortening and widening the sleeve to release the line and permit said movement of the line.

5. A method according to claim 4, wherein the sleeve is shortened by pushing its ends towards one another.

6. A method according to any preceding claim, comprising passing the line out of the sleeve through a wall of the sleeve.

7. A method according to claim 6, comprising passing the line back into the sleeve through the wall of the sleeve.

8. A method according to any preceding claim, comprising securing the line, checking the position of the line with respect to the patient by x-ray or other means, adjusting the line into a desired position, and locking it in the desired position.

9. A method according to claim 8, wherein locking is achieved by adhesively connecting the line and the sleeve.

10. A fastener for securing a line to a patient comprising a sleeve of variable length capable when lengthened of gripping the line.

11. A fastener according to claim 10, wherein the sleeve when shortened is capable of sliding along the line.

12. A fastener according to claim 10 or claim 11, further comprising attachment means for attaching the sleeve to a patient.

13. A fastener according to claim 12, wherein the attachment means comprises one or more loops.

14. A fastener according to claim 13, wherein the or each loop is formed by doubling over the sleeve.

15. A fastener according to any of claims 12 to 14, wherein the attachment means comprises a harness, sling or other means adapted to embrace a part of the patient.

16. A fastener according to any of claims 10 to 15, further comprising a support and movable means for varying the length of the sleeve with respect to the support.

17. A fastener according to claim 16, wherein the movable means includes bias means acting to elongate the sleeve.

18. A fastener according to claim 16 or claim 17, wherein the movable means includes at least one lever acting upon the sleeve.

19. A fastener according to claim 18, wherein the lever is a finger tab movable against the bias means to shorten the sleeve.

20. A fastener according to claim 19, wherein the finger tab is opposed by a corresponding formation on the support.

21. A fastener according to any of claims 10 to 20, wherein the sleeve has a perforated or foraminous wall defining a plurality of openings.

22. A fastener according to claim 21, wherein an opening is capable of permitting the line to pass through the wall of the sleeve.

23. A fastener according to claim 21 or claim 22, wherein the sleeve wall is a mesh, grid, net or web.

24. A fastener according to any of claims 21 to 23, wherein the sleeve is of filamentary construction.

25. A fastener according to any of claims 21 to 24, wherein the sleeve is a spirally woven tube.

26. Medical or surgical apparatus operating according to the method of any of claims 1 to 9 or including the fastener of any of claims 10 to 25.

27. A method of securing a line to a patient or of adjusting the position of a line thus secured, substantially as hereinbefore described with reference to or as illustrated in any of Figures 3 to 11 of the accompanying drawings.

28. A fastener for securing a line to a patient or medical or surgical apparatus including said fastener, substantially as hereinbefore described with reference to or as illustrated in any of Figures 3 to 11 of the accompanying drawings.

ABSTRACT

A method of securing a line to a patient or of adjusting the position of a line thus secured comprises elongating and narrowing a sleeve applied to the line to grip the line and resist movement of the line along its longitudinal axis with respect to the sleeve.

Also disclosed is a fastener for securing a line to a patient, the fastener comprising a sleeve of variable length capable when lengthened of gripping the line.

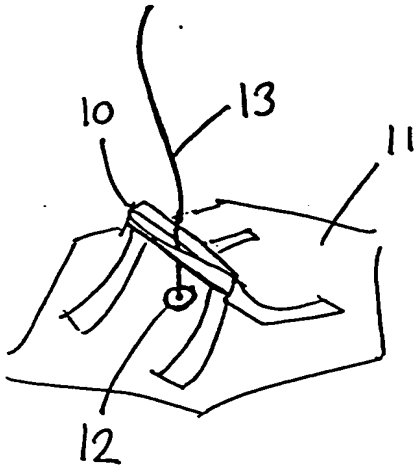


FIGURE 1

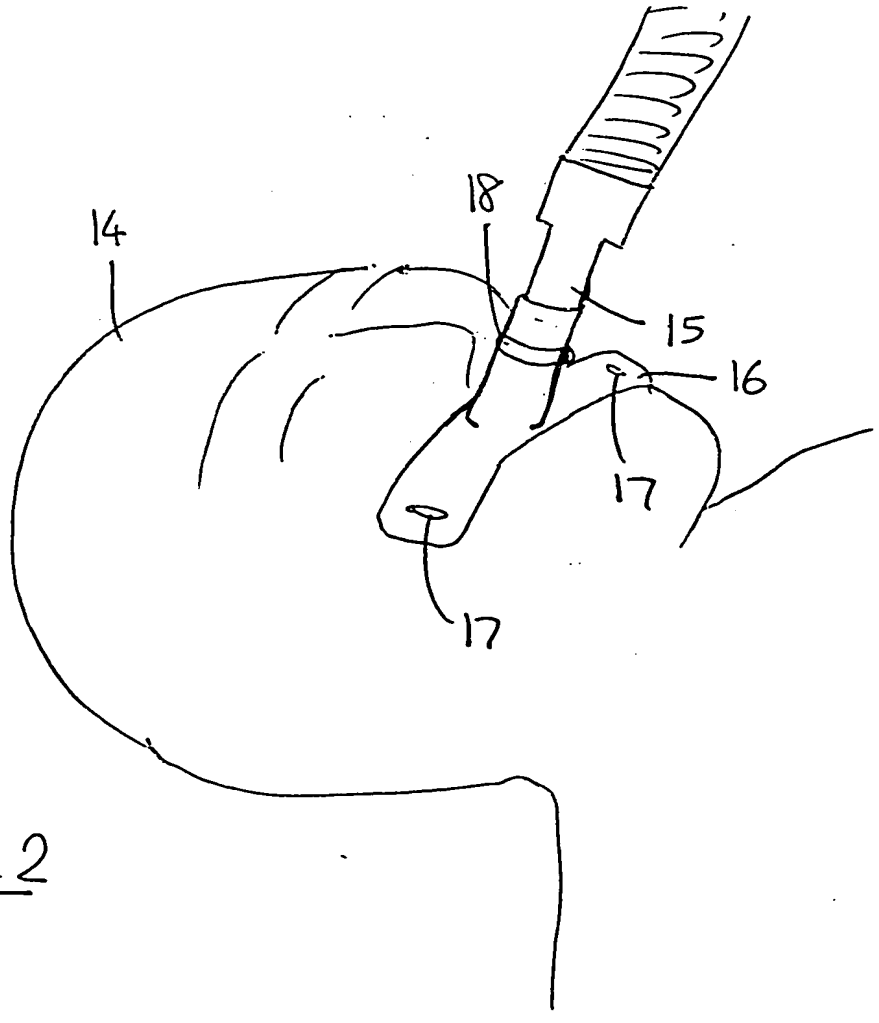


FIGURE 2

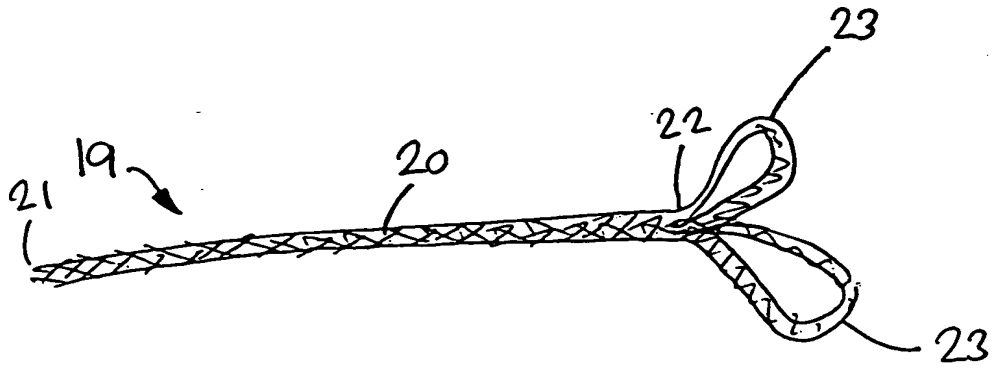


FIGURE 3

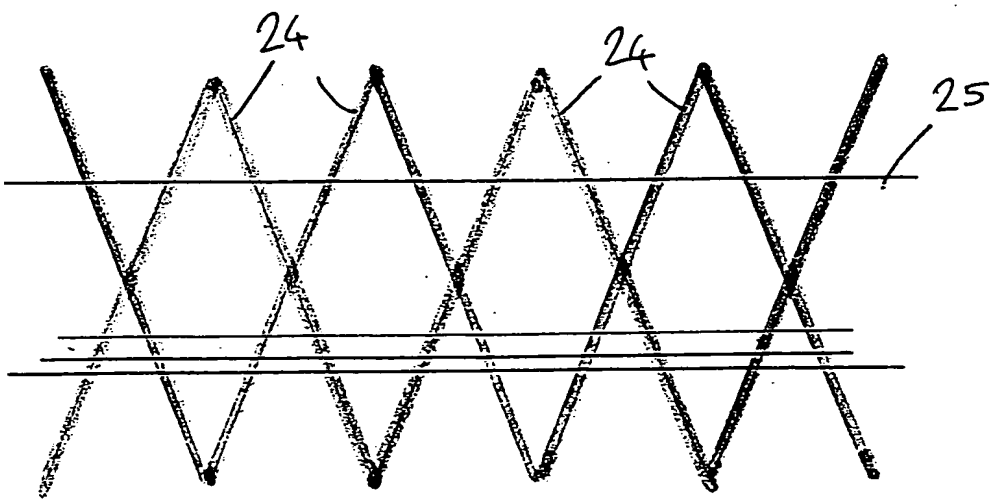


FIGURE 4(a)

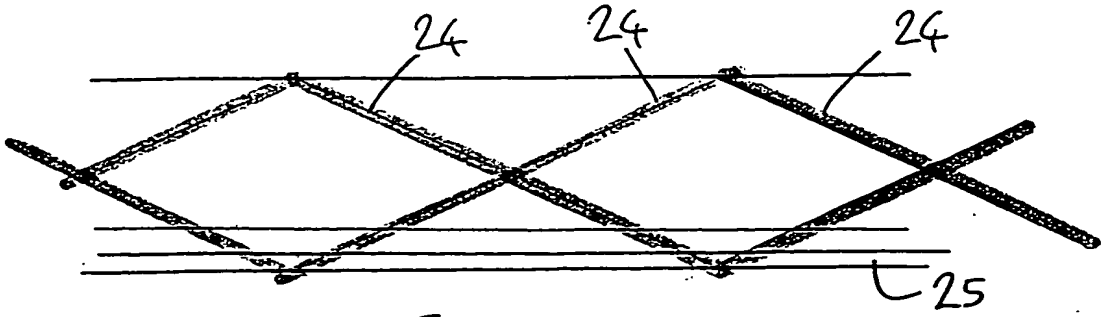


FIGURE 4(b)

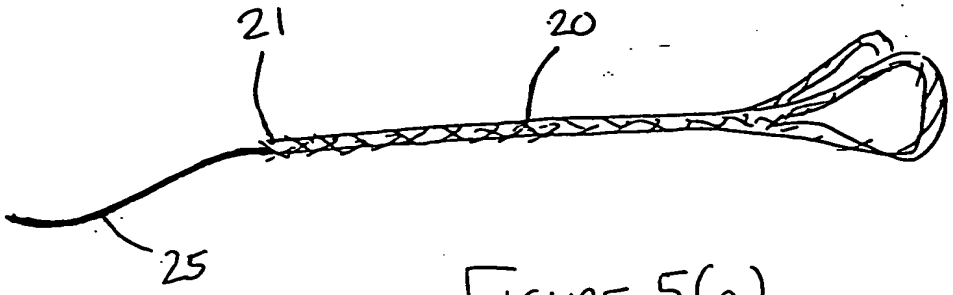


FIGURE 5(a)

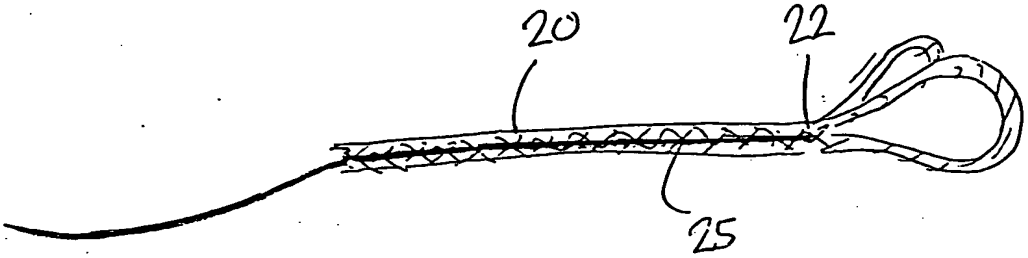


FIGURE 5(b)

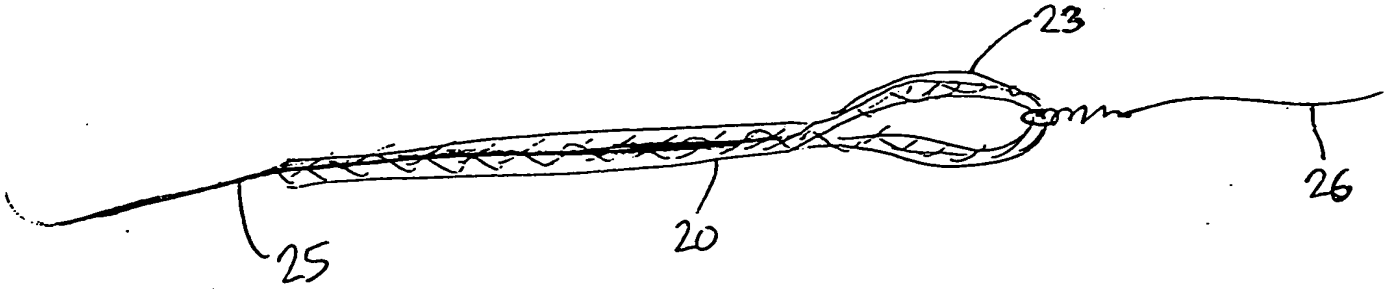


FIGURE 5(c)

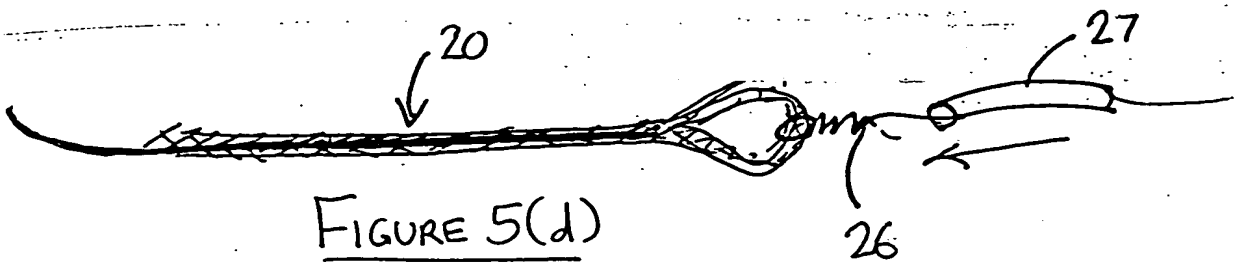


FIGURE 5(d)

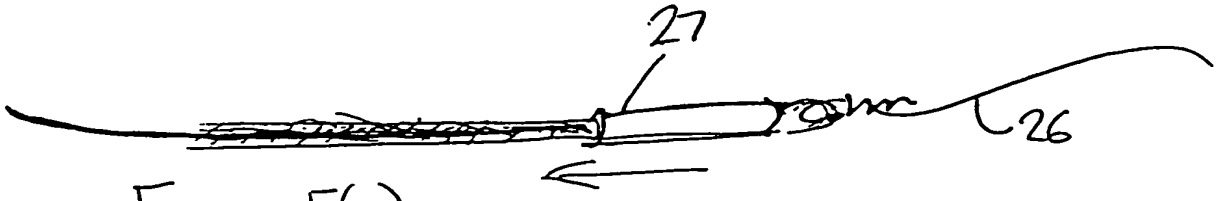


FIGURE 5(e)

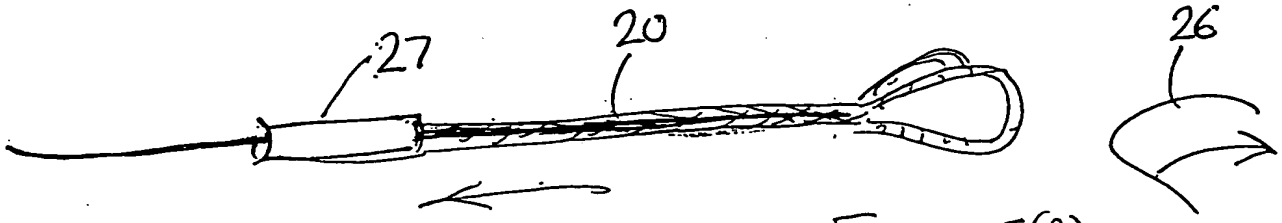


FIGURE 5(f)

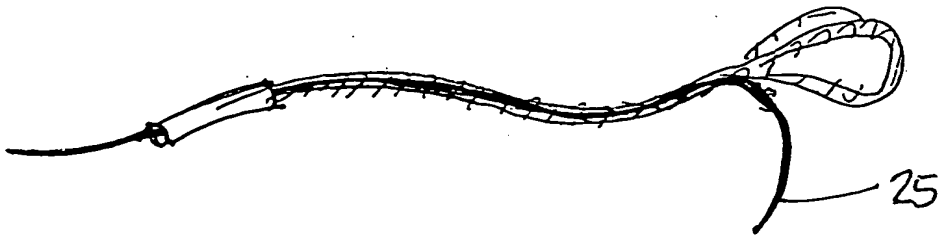


FIGURE 5(g)

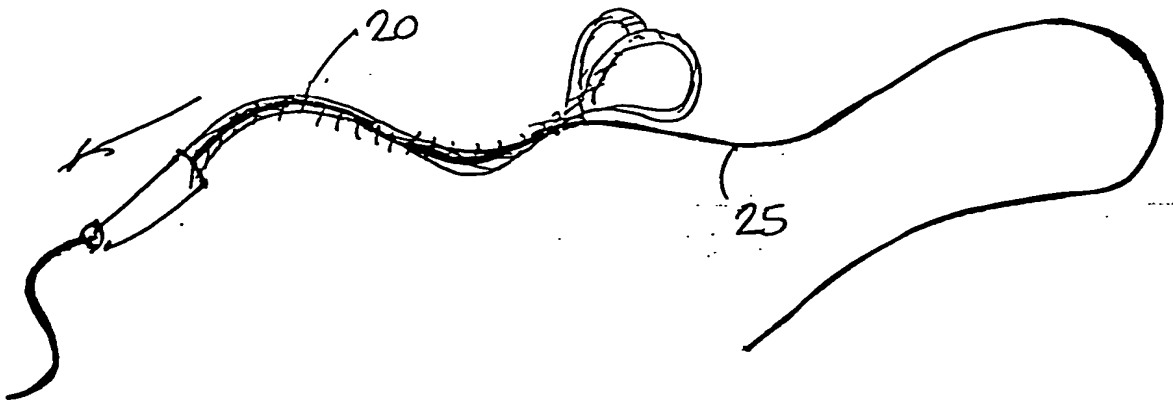


FIGURE 5(h)

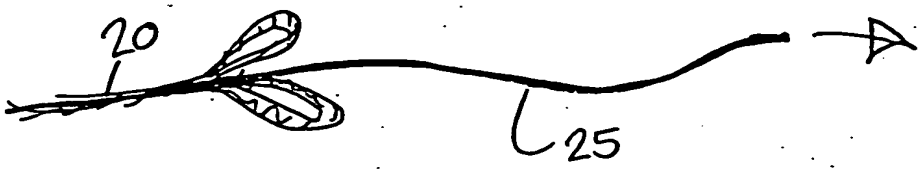


FIGURE 5(i)

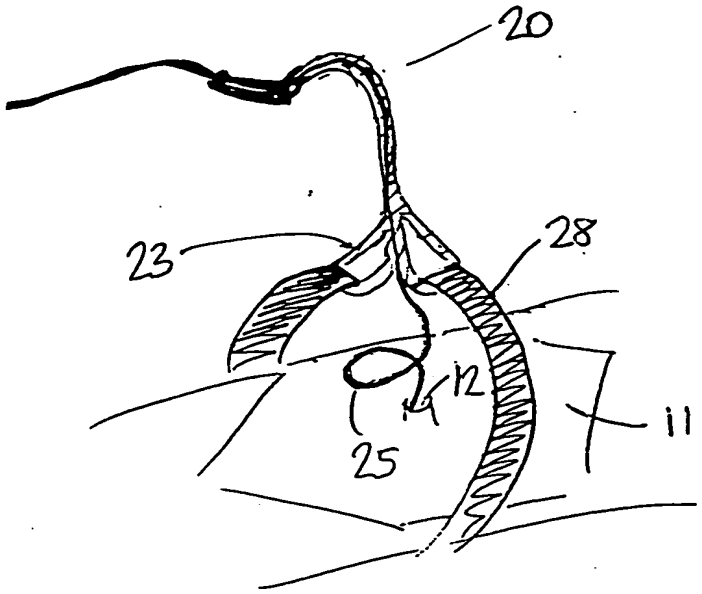


FIGURE 5(j)

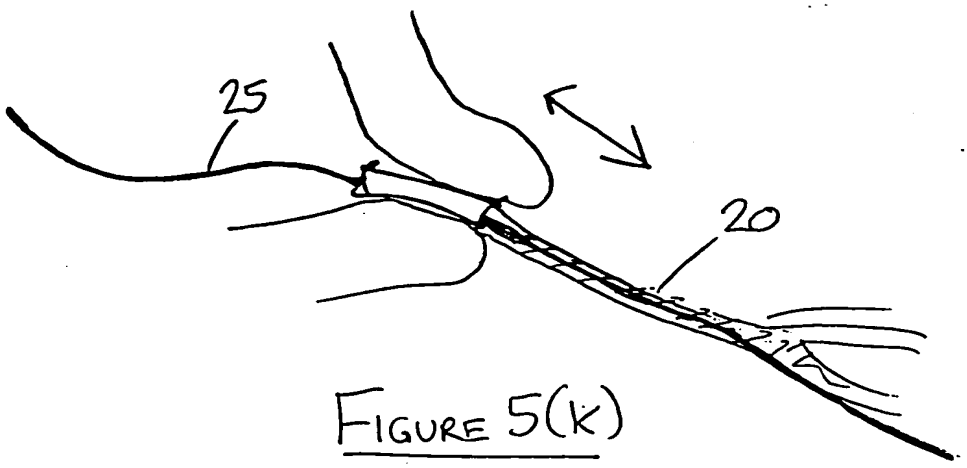


FIGURE 5(K)

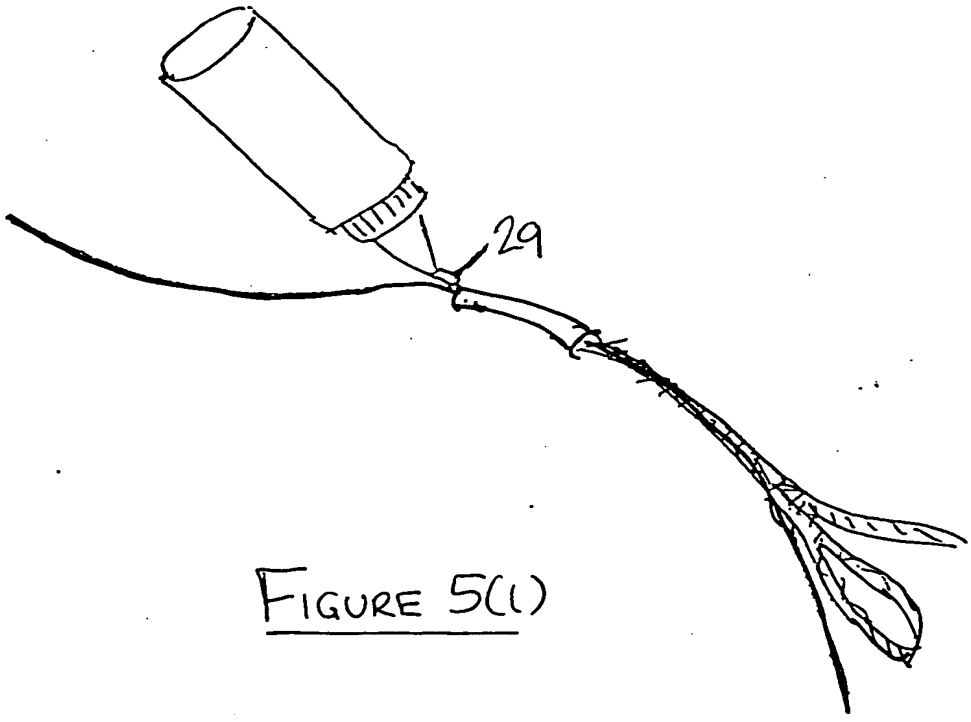


FIGURE 5(L)

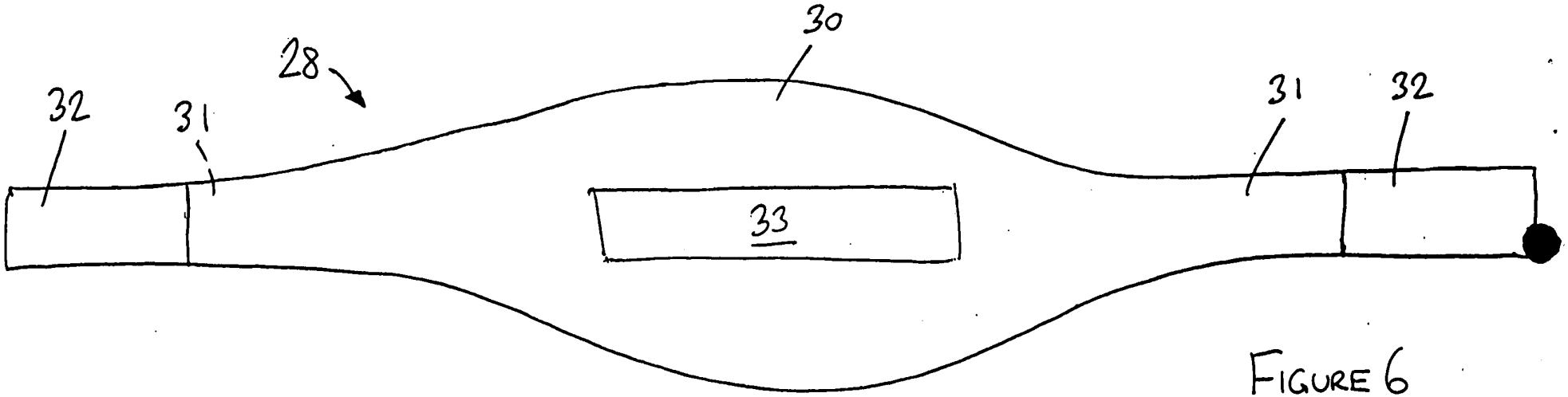


FIGURE 6

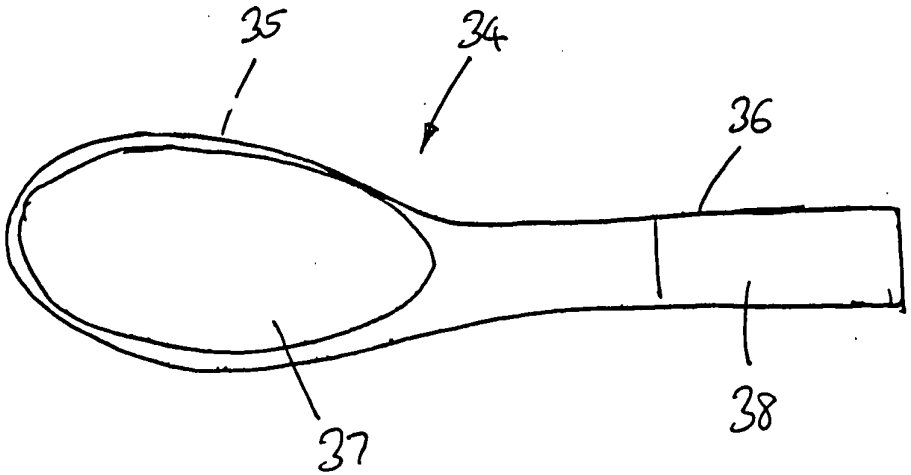


FIGURE 7

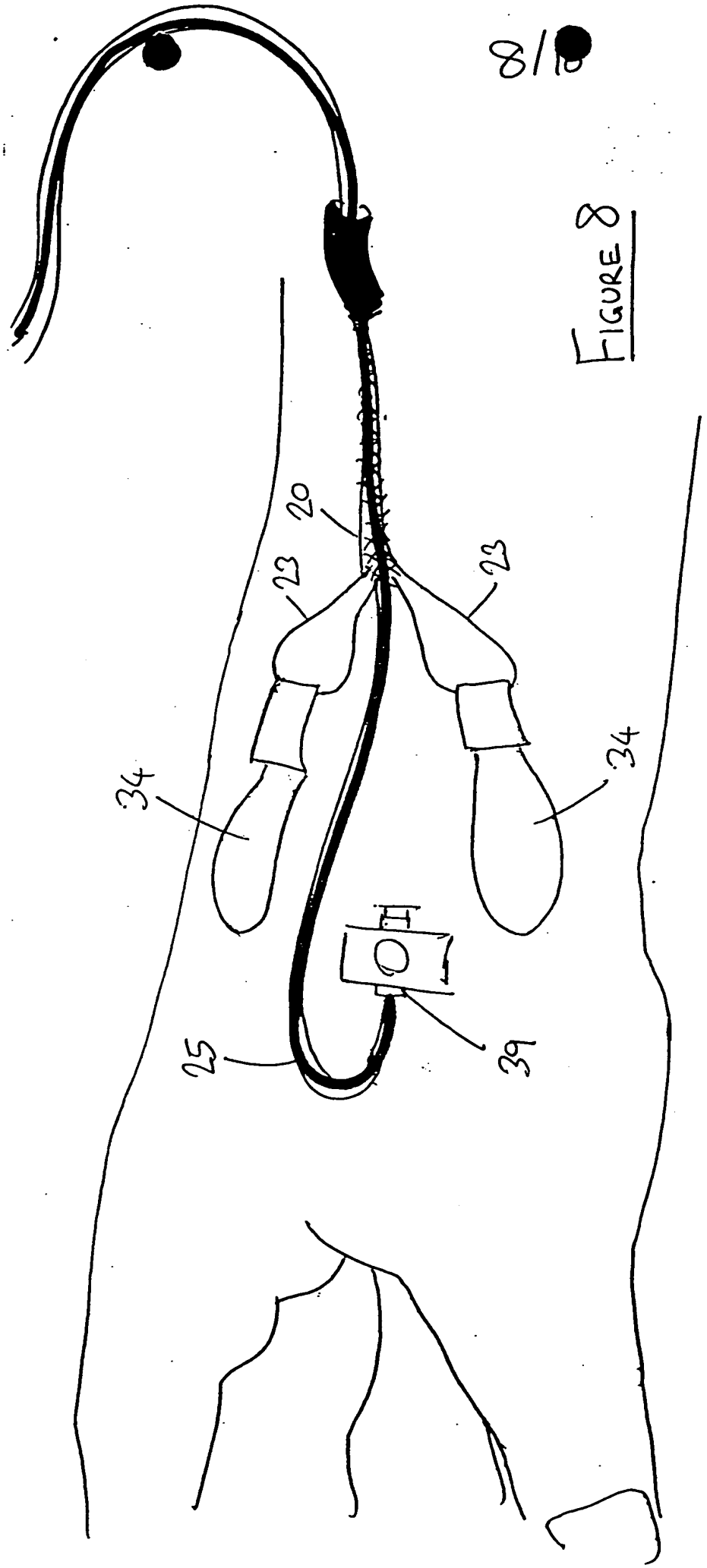
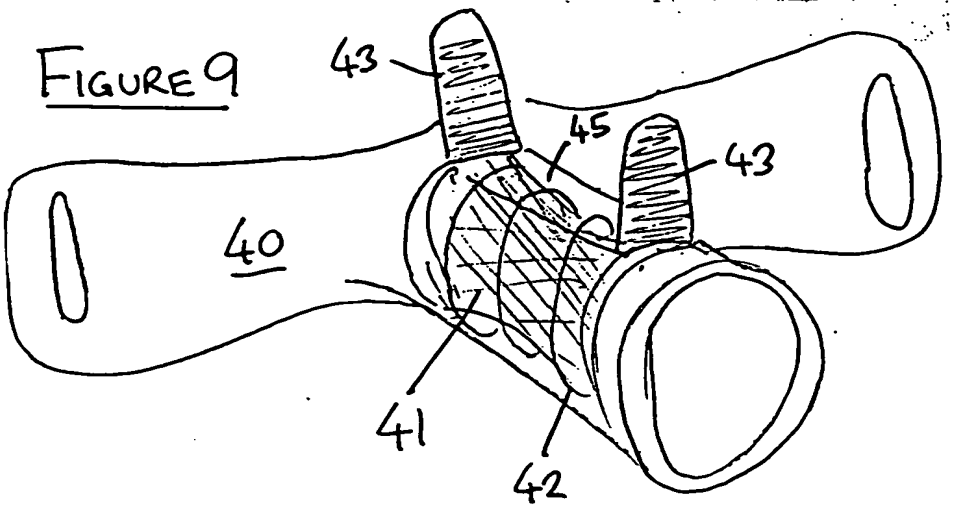


FIGURE 8

FIGURE 9



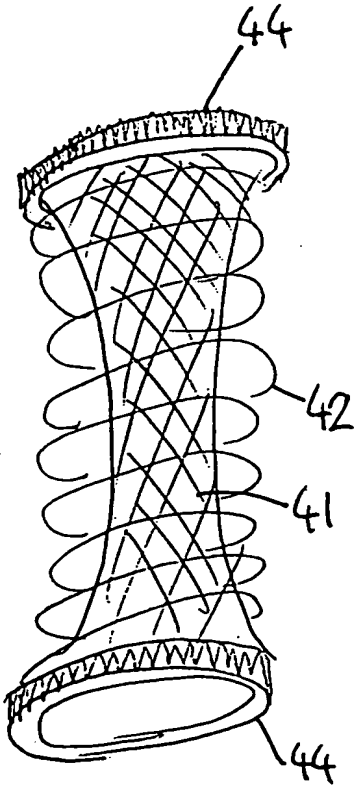


FIGURE 10(a)

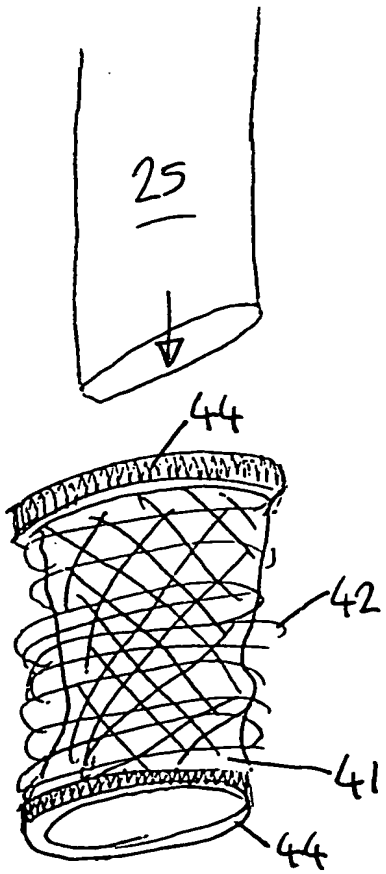


FIGURE 10(b)

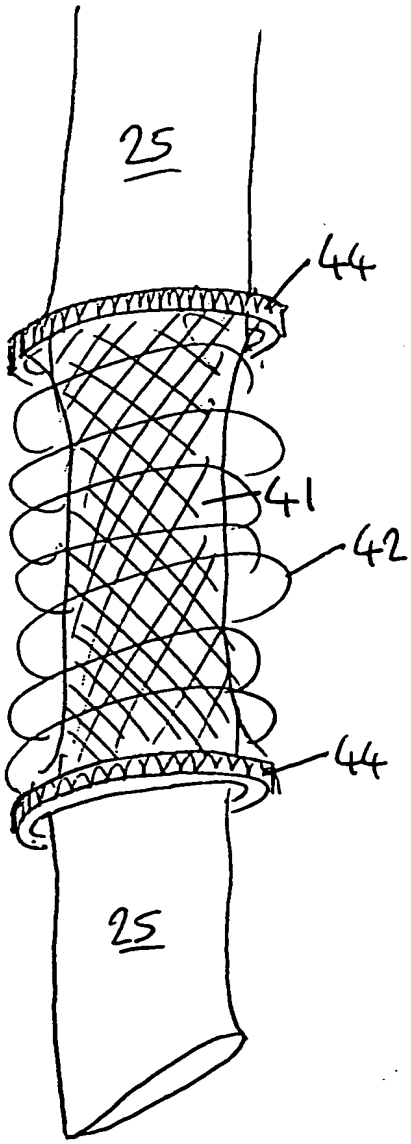


FIGURE 10(c)

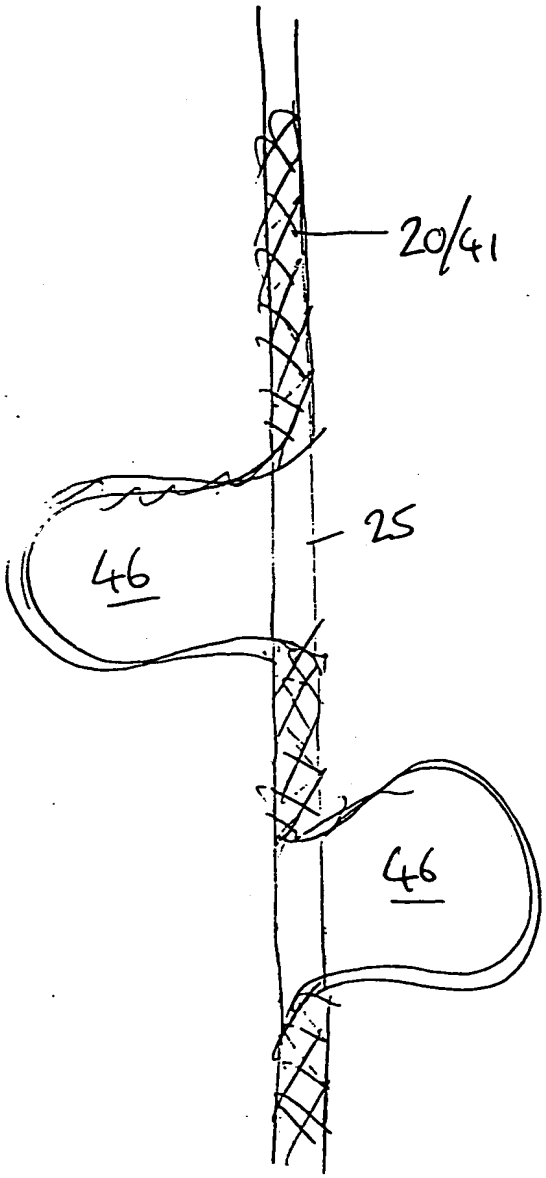


FIGURE 11(a)

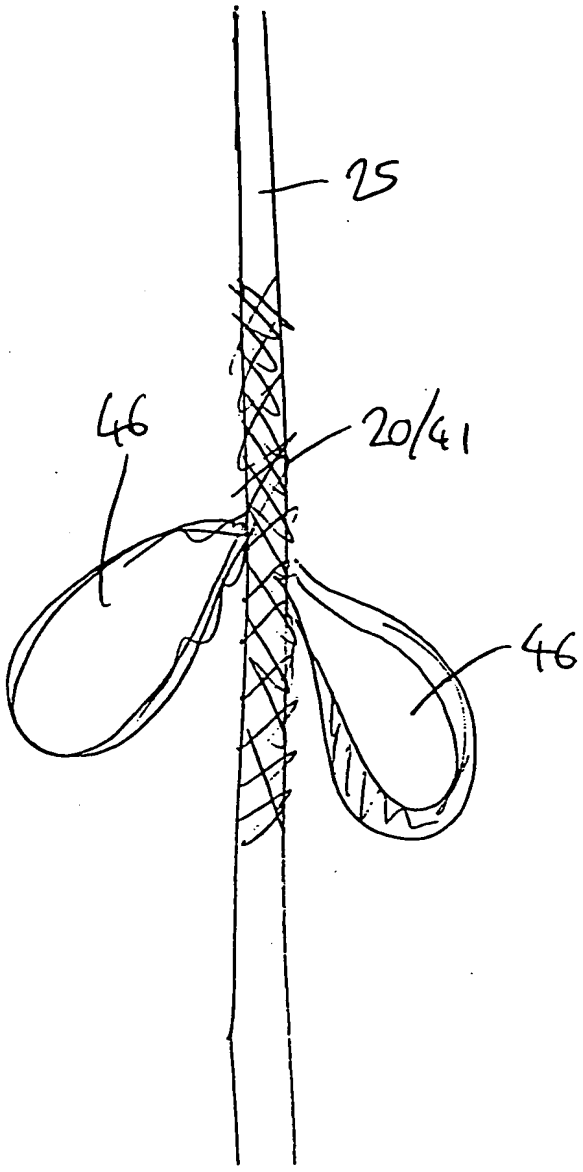


FIGURE 11(b)